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REACTION OF COTTON GENOTYPES TO BOLL ROT DISEASE OF COTTON

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ABSTRACT

Cotton (*Gossypium hirsutum* L.) is the most important fiber and oilseed crop cultivated in India and worldwide in different countries. The crop suffers from fungal, bacterial and viral diseases which leads to reduction in yield and deteriorates the fiber quality of cotton. Boll rot caused by fungal and bacterial pathogens is one of the emerging and devastating disease infecting the crop. To find resistant sources against the disease experiment was conducted in field condition by artificial inoculation. Fourteen non Bt hybrids/varieties and 23 Bt hybrids were screened. Among varieties screened not a single variety show resistant to disease. Out of 14 non Bt hybrids ten viz. Shwetambari (17.68%), Tarang (20.03%), Suman (21.5%), Mahi (21.59%), Shubhra (20.45%), Ekta (18.89%), Yamuna (26.42%), Rukhmai (19.38%), Chetna (19.99%), Wagad Kalyan (23.46%) were classified as moderately resistant. While among 23 Bt hybrids 15 hybrids viz., MRC-7351 (19.76%), PCH-99 (25.25%), Jaiho (17.67%), Dhandev (23.27%), Bouncer (17.88%), Jumbo-303 (19.93%), Asha-9011 (14.60%), Rashi-1971 (27.89%), MRC-7918 (20.45%), RCH-929 (18.15%), RCH-2 (19.41%), Prestij-932 (18.33%), Moksha (19.71%), Asha (23.50%), RCH-386 (20.03%) showed moderately resistant disease reaction to boll rot disease.

Key words : Cotton, Boll rot complex, Screening.

Introduction

Cotton (*Gossypium hirsutum* L.) belonging to family Malvaceae is the most important fiber and oilseed crop. It is native to tropical and subtropical regions around the world including Africa, America, India and Egypt. There are four commercially grown species of cotton; *Gossypium hirsutum*-upland cotton, native to central America and Mexico, *Gossypium barbadense*- extra-long staple cotton, belonging to tropical South America, *Gossypium arboreum*- tree cotton belonging to India and Pakistan and *Gossypium herbaceum* belonging to South America and Arabian peninsula. Among these, varieties *Gossypium hirsutum* and *Gossypium barbadense* are most preferable for cotton production.

Cotton is called as “king of fiber” as well as “white gold”. Its cultivation is also of great social importance

due to the number of jobs generated directly or indirectly. The fiber and seed production of cotton has many industrial applications. In addition of providing fiber, cotton seeds are used to produce animal feed and also edible oil.

India has the largest area under cotton cultivation (118 lakh ha.) followed by United States of America. India contributes 20.67 per cent of world's cotton production. Moreover, India is the second largest cotton producer in the world (250 lakh bales), but yield per hectare in India is markedly poor i.e.; 461 kg/ha (Anonymous, 2024). In India, Maharashtra ranks first in area under cotton cultivation (40.84 lakh ha) followed by Gujrat (23.92lakh ha). Similarly in production, the state ranks first (84.80 lakh bales) followed by Gujarat (84.01 lakh bales). However, in terms of productivity Gujrat stands first (597 kg/ha) (Anonymous, 2024).

Among several reasons of low productivity and production of cotton, diseases contribute substantially to low yields of cotton. There are so many diseases that can affect the crop, each with different severity. Among these, *Alternaria* leaf spot, *Cercospora* leaf spot, grey mildew, *Fusarium* wilt, *Verticillium* wilt, root rot, bacterial blight, boll rot, cotton leaf curl virus, tobacco streak virus are some of the major cotton diseases in India. Boll rots are of great importance as they directly affect the bolls and reduces yield. The term boll rot is generally used to describe damage to green or mature cotton bolls that exhibit degradation of fiber, seed, and/or the carpel wall. Such damage may result from infection by pathogens, either directly or vectored by insects of the orders Heteroptera and Hemiptera (Medrano *et al.*, 2009).

Boll rot is a complex disease and caused by many pathogens such as *Colletotrichum gossypii*, *Alternaria macrospora*, *A. alternata*, *Botryodiplodia theobromae*, *Diplopia gossypiana*, *Exserohilum rostratum*, *Fusarium* spp., *Aspergillus niger*, *Rhizopus* spp. and *Trichothecium roseum*. Some bacteria viz., *Pantoea dispersa*, *Pantoea agglomerans*, *Xanthomonas citri* sub. sp. *malvacearum* also cause boll rot (Nagrle *et al.*, 2020).

Yield losses caused by boll rot were estimated in different cotton growing areas throughout the world showed great economic losses. On an average, 10 per cent losses due to diseases have been reported from India (Dastur *et al.*, 1960). Cotton yield losses of 10-15 per cent was reported due to seed and boll rot in South Carolina (Kindall, 2013). Bagga (1968) estimated that an internal infection of 30-40 per cent green bolls by boll rotting pathogens can cause annual yield losses amounting 18 million dollars. Shamsi and Naher (2014) estimated 75 per cent of total fruit loss due to boll rot. Iamamoto (2007) reported that cotton bolls rot can cause 20-30 per cent losses in productivity and in general, affected plants losses the best quality cotton fiber due to boll rot disease. Disease management by using chemicals is laborious, costly and hazardous to nature. Resistant sources identification is a sustainable approach in

ecofriendly disease management. The present study added new information regarding resistant sources against boll rot complex.

Materials and Methods

Twelve non Bt cotton varieties released by cotton improvement Project, MPKV, Rahuri and two released by MPUAT, Udaipur along with 23 popular Bt hybrids were screened under artificial inoculation condition by spraying spore suspension of isolated boll rot causing fungal and bacterial pathogens. The experiment was conducted in open field at Cotton Improvement Project, MPKV, Rahuri during *kharif* season 2024-25.

Observations on incidence of boll rot were recorded in each variety /hybrid at periodic interval. The disease reaction was recorded by using following scale given by Sheo Raj (1988).

The percent of boll rot disease incidence was recorded using the following formula (Wheeler, 1969).

$$\text{Percent disease incidence} = \frac{\text{Number of infected bolls}}{\text{Total numbers of bolls observed per plant}} \times 100$$

The details of experiment were as follows:

The genotypes were sown on ridges and furrows at spacing 90 × 60 cm (non Bt), 90 × 90 cm (Bt).

Results and Discussion

The data on per cent disease incidence of boll rot recorded in the genotypes and disease reaction is presented in Table 2.

From the data, it is revealed that none of the variety/hybrid was found to be free from disease infection. However, 10 non Bt hybrids/varieties viz.; Shwetambari, Tarang, Suman, Mahi, Shubhra, Ekta, Yamuna, Rukhmai, Chetna, Wagad Kalyan were recorded moderately resistant reaction with disease incidence between 17.68 to 26.42 per cent. Two varieties, Dhanwantari and Anmol were moderately susceptible and Phule-688 and Suraj were classified as susceptible (Table 2a).

Table 1 : Disease rating scale used to screen cotton varieties/hybrids.

Grade	Reaction	Symptom details
0	Disease free (DF)	Without any bacterial and fungal spot
1	Resistant (R)	Minute spot not spreading on the surface of boll
2	Moderately Resistant (MR)	Spots increasing in size but not penetrating and also not affecting lint of seed
3	Moderately Susceptible (MS)	Infection spreading to one or two locules and causing damage to lint and seed.
4	Susceptible (S)	More than two locules affected by fungal or bacterial infection causing damage to lint and seed.

Table 2 : Reaction of cotton non Bt varieties/hybrids to boll rot disease under field condition (artificial inoculation).

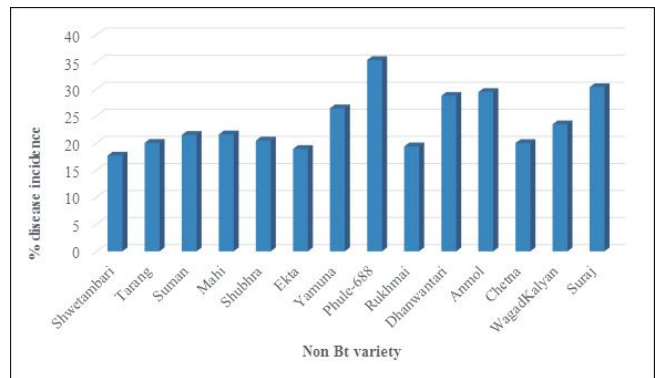
S. no.	Name of variety/hybrid	% Disease Incidence	Grade	Disease reaction
1	Shwetambari	17.68	2	MR
2	Tarang	20.03	2	MR
3	Suman	21.5	2	MR
4	Mahi	21.59	2	MR
5	Shubhra	20.45	2	MR
6	Ekta	18.89	2	MR
7	Yamuna	26.42	2	MR
8	Phule-688	35.33	4	S
9	Rukhmai	19.38	2	MR
10	Dhanwantari	28.72	3	MS
11	Anmol	29.42	3	MS
12	Chetna	19.99	2	MR
13	Wagad Kalyan	23.46	2	MR
14	Suraj	30.32	4	S

MR-Moderately resistant, R- Resistant, MS- Moderately susceptible.

Table 2a : Categorization of cotton non Bt hybrids/varieties according to disease reaction.

S. no.	Disease reaction	Number of hybrids	Hybrids/varieties
1	Disease free (DF)	0	—
2	Resistant (R)	0	—
3	Moderately Resistant(MR)	10	Shwetambari, Tarang, Suman, Mahi, Shubhra, Ekta, Yamuna, Rukhmai, Chetna, Wagad Kalyan
4	Moderately Susceptible (MS)	2	Dhanwantari, Anmol
5	Susceptible (S)	2	Phule-688, Suraj

From the data presented in Table 3, it is revealed that not a single Bt hybrid was found disease free. However, 15 Bt hybrids viz., MRC-7351, PCH-99, Jaiho, Dhandev, Bouncer, Jumbo-303, Asha-9011, Rashi-1971, MRC-7918, RCH-929, RCH-2, Prestij-932, Moksha, Asha, RCH-386 showed moderately resistant disease reaction and the per cent disease incidence in these hybrids ranged between 17.67 to 27.89. Seven Bt hybrids viz., NCH-854, US-7067, Ajeet-199, Dhandev plus, Ajeet-155, Jadoo, SP-7147 showed moderately susceptible reaction against boll rot disease. One Bt hybrid VIP Gold-904 showed susceptible disease reaction (Table 3a).

**Fig. 1 :** Reaction of cotton non Bt varieties/hybrids to boll rot disease under field condition (artificial inoculation).**Table 3 :** Reaction of cotton Bt hybrids to boll rot disease under field condition (artificial inoculation).

S. no.	Name of hybrid	Disease Incidence	Grade	Disease reaction
1	NCS-854	27.46	3	MS
2	US-7067	28.49	3	MS
3	Ajeet-199	28.98	3	MS
4	MRC-7351	19.76	2	MR
5	VIP Gold 904	51.33	4	S
6	PCH-99	25.25	2	MR
7	Jai Ho	17.67	2	MR
8	Dhandev plus	34.69	3	MS
9	Dhandev	23.27	2	MR
10	Bouncer	17.88	2	MR
11	Jumbo-303	19.93	2	MR
12	Asha 9011	14.60	2	MR
13	Rashi1971	27.89	2	MR
14	Ajeet-155	41.86	3	MS
15	MRC 7918	20.45	2	MR
16	Jadoo	29.22	3	MS
17	SP 7147	21.42	3	MS
18	RCH-929	18.15	2	MR
19	RCH-2	19.41	2	MR
20	RCH-386	20.03	2	MR
21	Prestij-932	18.33	2	MR
22	Moksha	19.71	2	MR
23	Asha	23.50	2	MR

MR-Moderately resistant, R- Resistant, MS- Moderately susceptible.

Sandipan *et al.* (2018) screened 44 cotton entries by artificial inoculation of bacterial leaf blight pathogen. Artificial inoculation was made twice by preparing spore suspension of *Xanthomonas campestris* pv. *malvacearum*. Nanda and Kulkarni (2020) screened 118 genotypes/varieties/hybrids against boll rot disease complex under natural epiphytotic condition at Dharwad.

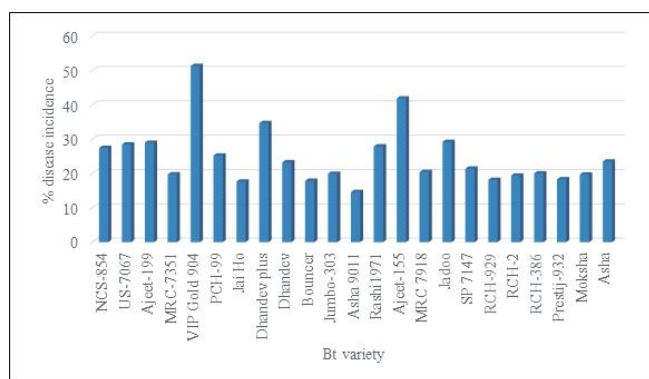


Fig. 2 : Reaction of cotton Bt hybrids to boll rot disease under field condition (artificial inoculation).

Table 3a: Categorization of cotton Bt hybrids according to disease reaction.

S. no.	Disease reaction	Number of hybrids	Hybrids
1	Disease free (DF)	0	—
2	Resistant (R)	0	—
3	Moderately Resistant(MR)	15	MRC-7351, PCH-99, Jai ho, Dhandev, Bouncer, Jumbo, Asha 9011, Rashil 1971, MRC 7918, RCH-929, RCH-2, Prestij-932, Moksha, Asha, RCH-386
4	Moderately Susceptible(MS)	7	NCH-854, US-7067, Ajeet-199, Dhandev plus, Ajeet-155, Jadoo, SP-7147
5	Susceptible (S)	1	VIP Gold-904

Bhaskar (2022) screened thirteen Bt cotton hybrids against cotton boll rot disease, one entry Arika was found resistant to boll rot disease. Other scientists Naik (1998), Chinthagunta *et al.* (2009), Zangi (2014) also screened cotton hybrids/ varieties against boll rot. The present results are in align with previous researchers. Bt hybrids/ non Bt hybrids/varieties identified as moderately resistant are important sources from farmer's point of view and also for inclusion of the same in breeding programme.

Conclusion

From the outcome of the present research, it is concluded that none of the variety/ hybrid is resistant to the boll rot disease. Varieties/hybrids, which were found moderately resistant to disease will be useful for breeders to develop boll rot tolerant varieties in future, which will be helpful in reducing yield losses due to boll rot.

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